CLAIMS

What is claimed is:

1. A method of forwarding a tunneled packet having a header identifying a tunnel end point and a payload, in a data communications network, comprising the steps performed at a forwarding node of:

recognizing a tunneled packet identifying a neighbor node to the forwarding node as tunnel end point,

removing the header and

forwarding the payload to the neighbor node.

2. A method as claimed in claim 1 further comprising the step of recording at the forwarding node one or more neighbor nodes comprising tunnel end points and permission to remove headers for tunneled packets to the or each recorded neighbor node.

3. A method as claimed in claim 2 in which the recording step comprises a manual configuration recording step.

4. A method as claimed in claim 2 in which the recording step is carried out upon receipt of a notification from a tunnel end point.

5. A method as claimed in claim 4 further comprising the step of constructing as a repair path around a component in the data communications network a tunnel having a tunnel end point prior to issuing the notification from the tunnel end point.

6. A method as claimed in claim 1 in which the payload is one of a further tunneled packet or a direct forwarded packet.

7. A method as claimed in claim 6 in which the tunneled packet is configured as one of IP/GRE/MPLS/IP-payload or IP/GRE/IP/GRE/IP-payload.

8. A method as claimed in claim 6 further comprising the step, at an originating node, of encapsulating the payload in a tunneled packet and tunneling the packet to the tunnel end point.

9. A computer readable medium comprising one or more sequences of instructions for forwarding a tunneled packet having a header identifying a tunnel end point and a payload, in a data communications network, which instructions, when executed by one or more processors, cause the one or more processors to perform the steps of the method of any of claims 1, 2, 3, 4, 5, 6, 7 or 8.

10. An apparatus for forwarding a tunneled packet having a header identifying a tunnel end point and a payload, in a data communications network, comprising:

means for recognizing a tunneled packet identifying a neighbor node as tunnel end point,

means for removing the header and

means for forwarding the payload to the neighbor node.

11. An apparatus as claimed in claim 10 further comprising:

means for recording one or more neighbor nodes comprising tunnel end points and for recording permission to remove headers for tunneled packets to the or each recorded neighbor node.

12. An apparatus as claimed in claim 11 in which the means for recording comprises means for manually configuring recordal.

13. An apparatus as claimed in claim 11 in which the means for recording is arranged to carry out recordal upon receipt of a notification from a tunnel end point.

14. An apparatus as claimed in claim 13 further comprising means for constructing as a repair path around a component in the data communications network a tunnel having a tunnel end point in which the means for constructing the repair path is arranged to construct the repair path prior to issue of the notification from the tunnel end point.

15. An apparatus as claimed in claim 10 in which the payload is one of a further tunneled packet or a direct forwarded packet.

16. An apparatus as claimed in claim 15 in which the tunneled packet is configured as one of IP/GRE/MPLS/IP-payload or IP/GRE/IP/GRE/IP-payload.

17. An apparatus as claimed in claim 15 further comprising means for encapsulating the payload in a tunneled packet and tunneling the packet to the tunnel end point.

18. An apparatus for forwarding a tunneled packet having a header identifying a tunnel end point and a payload, in a data communications network, the apparatus comprising:

one or more processors;

a network interface communicatively coupled to the processor and configured to communicate one or more packet flows among the processor and a network; and

a computer readable medium comprising one or more sequences of instructions for forwarding a tunneled packet having a header identifying a tunnel end point and a payload, in a data communications network, which instructions, when executed by one or more processors, cause the one or more processors to perform the steps of the method of any of claims 1, 2, 3, 4, 5, 6, 7 or 8.

19. A method of configuring a forwarding node in a data communications network to process tunneled packets having a header identifying a tunnel end point and a payload, comprising the steps, at a notifying node, of:

notifying a forwarding node of the identity of a tunnel end point and

permitting the forwarding node to process tunneled packets to the tunnel end point by removing the header and forwarding the payload to the tunnel end point.

20. A method as claimed in claim 19 in which the notifying node is the tunnel end point.

21. A method as claimed in claim 19 in which the forwarding node is a neighbor node to the tunnel end point.

22. A method as claimed in claim 19 further comprising the step of constructing as a repair path around a component in the data communications network a tunnel having a tunnel end point prior to issuing the notification from the notifying node.

23. A computer readable medium comprising one or more sequences of instructions for configuring a forwarding node in a data communications network to process tunneled packets having a header identifying a tunnel end point and a payload, which instructions, when executed by one or more processors, cause the one or more processors to perform the steps of the method of any of claims 19, 20, 21 or 22.

24. An apparatus for configuring a forwarding node in a data communications network to process tunneled packets having a header identifying a tunnel end point and a payload, comprising:

means for notifying a forwarding node of the identity of a tunnel end point node and

means for permitting the forwarding node to process tunneled packets to the tunnel end point by removing the header and forwarding the payload to the tunnel end point.

25. An apparatus as claimed in claim 24 in which the means for notifying is the tunnel end point.

26. An apparatus as claimed in claim 24 in which the forwarding node is a neighbor node to the tunnel end point.

27. An apparatus as claimed in claim 24 further comprising means for constructing as a repair path around a component in the data communications network a tunnel having a tunnel end point in which the means for constructing the repair path is arranged to construct the repair path prior to issue of the notification from the means for notifying.

28. An apparatus for configuring a forwarding node in a data communications network to process tunneled packets having a header identifying a tunnel end point and a payload, the apparatus comprises one or more processors; a network interface communicatively coupled to the processor and configured to communicate one or more packet flows among the processor and a network; and a computer readable medium comprising one or more sequences of instructions for configuring a forwarding node in a data communications network to process tunneled packets having a header identifying a tunnel end point and a payload, which instructions, when executed by one or more processors, cause the one or more processors to perform the steps of the method of any of claims 19, 20, 21 or 22.

29. A method of constructing a backup route from a first node in a data communications network having as components nodes and links, around a component, comprising the steps of:

computing a spanning tree, rooted at the first node, of available nodes which excludes nodes reachable by traversing the component,

assigning to an available node a cost equal to minus the cost of reaching the available node from the first node and

re-computing the spanning tree taking into account the assigned cost.

30. A computer readable medium comprising one or more sequences of instructions for constructing a backup route from a first node in a data communications network having as components nodes and links, around a component, which instructions, when executed by one or more processors, cause the one or more processors to perform the steps of the method of claim 29.

31. An apparatus for constructing a backup route from a first node in a data communications network having as components nodes and links, around a component, comprising:

means for computing a spanning tree, rooted first at the node, of available nodes which excludes nodes reachable by traversing the component,

means for assigning to an available node a cost equal to minus the cost of reaching the available node from the first node and

means for re-computing the spanning tree taking into account the assigned cost.

32. An apparatus for constructing a backup route from a first node in a data communications network having as components nodes and links, around a component, the apparatus comprising:

one or more processors;

a network interface communicatively coupled to the processor and configured to communicate one or more packet flows among the processor and a network; and

a computer readable medium comprising one or more sequences of instructions for constructing a backup route from a first node in a data communications network having as components nodes and links, around a component, which instructions, when executed by one or more processors, cause the one or more processors to perform the steps of the method of claim 29.